for all crops. Except in southern California, no rain fell in California during the first nine days. On the 10th snow fell in the mountains, and on the 11th showers were general in California south of the Tehachapi. A hailstorm occurred at Los Angeles on April 11th. Moderate disturbances prevailed in California north of the Tehachapi April 15th to 19th. Heavy rain and snow fell in Nevada April 26th.—*A. G. McAdie, Professor and District Forecaster.*

NORTH PACIFIC FORECAST DISTRICT.

The month of April was unusually pleasant in the North Pacific States, and no storms of consequence or destructive winds passed over the district. Sharp frosts occurred on several mornings, doing considerable damage to early fruit and tender vegetables. As a rule, these frosts were accurately forecast.—*A. B. Wollaber, Acting District Forecaster.*

RIVERS AND FLOODS.

Ice disappeared from the rivers of New England and the Red River of the North about the 2d and 3d. There was little trouble from ice gorges. The ice rotted and melted, broke up when the waters began to rise, and passed away without gorging.

The Mississippi River was highest during the early portion of the month, and fell gradually during the last part of the month. Owing to heavy rains, the tributaries of the Mississippi began to rise at the headwaters during the latter part of the month, but did not reach danger-line stages.

Warnings were issued for the Red River on the 6th, the Trinity, Chichasawhay, Leaf, and Pearl rivers on the 25th, and for the Brazos on the 30th. The first warnings for the Rio Grande, in the new Denver district, were issued on the 25th. The high water was the result of the heavy rains and melting snow in the Southwest during the third decade of the month.

There was considerable snow at the close of April throughout the mountain districts of the Southwest, which may cause a considerable flow of water in the streams of that region as it melts. The snowfall in the northwestern mountain districts is unusually light, and but little water is looked for in the northern streams during the spring and summer.

The highest and lowest water, mean stage, and monthly range at 291 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*E. B. Garriott, Professor.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Divison.

The following summaries relating to the general weather and crop conditions during April are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon reports from cooperative observers and crop correspondents, of whom there are about 3300 and 14,000, respectively:

Alabama.—Weather generally favorable for work and growth, except that the cold of the 17th seriously damaged nearly all crops in northern counties; considerable cotton killed in middle district. Nearly all cotton planted, or replanted, with stands good and chopping well advanced by close of month. Upland corn, wheat, oats, and early and replanted minor crops advanced well. Lowland planting backward. Strawberries yielded well. Fruit a failure north, one-half to two-thirds average crop promised in middle and southern counties.—*F. P. Chaffee.*

Arizona.—Precipitation was largely in excess, and the temperature deficient. Heavy to killing frosts, 2d to 20th, resulted in slight injury to vegetables and fruit. Wheat, barley, and oats were well headed in southern counties last decade; in northern counties these crops were backward, owing to the continued cold and wet weather. All desert cacti blooming by the 25th. Garden truck was plentiful; water in abundance; ranges excellent; stock sleek and fat, with minimum loss. Fruit crop practically safe.—*L. N. Jesunofsky.*

Arkansas.—Excessive rains delayed farm operations over the greater portion of the State. As a result less than usual amount of cotton land was prepared and very little planting was done. Corn planting advanced fairly well and considerable corn was up to fair to good stands. Wheat, oats, potatoes, and grasses made satisfactory progress. Fruits and berries of all kinds were promising, except peaches in northwest portion.—*Edward B. Richards.*

California.—The temperature for the month was nearly normal and the precipitation slightly below average. The snowfall in the mountains was also less than usual. No severe frosts occurred, but the frosts at the close of March injured deciduous fruits considerably, and in some sections they were damaged by high winds and hailstorms during the latter part of April. Large shipments of cherries, strawberries, and asparagus were made to eastern markets.—*Alexander G. McAdie.*

Colorado.—Conditions were generally unfavorable. Excessive moisture retarded work and cold weather delayed germination and growth. Winter wheat remained in fine condition. Spring wheat was nearly all sown and growing nicely. Seeding of oats was well under way, some being up. Planting of sugar beets was backward. Some planting of potatoes was done. Alfalfa did well and grass was generally good. Fruits were backward, but coming into bloom; peach crop is expected to be light.—*F. H. Brandenburg.*

Florida.—Work progressed very well under generally favorable weather conditions. The month was 1° warmer than the normal, with about the average amount of precipitation. Rainfall was greatest in Lee County, and least over western counties of the northern district, where the monthly total was less than one inch. Cotton germinated to generally good stands, although some replanting was necessary as a result of cold weather. Corn advanced nicely; the early planting in southern counties was in tassel. Citrus trees made a good growth, although the prospects were that the crop would be short.—*A. J. Mitchell.*

Georgia.—The temperature was low on the 7th and below freezing in the northern half of State on the 17th and 18th; most of the fruit and tender vegetation killed; little damage southern half, where the outlook for fruit continued promising. Latter part of month warm. Rainfall well distributed. Spring planting almost completed; early corn up to good stand, being cultivated southern half, making rapid growth; cotton doing well, early planted nice stand, being chopped southern half State, acreage decreased considerably. Oats and wheat unusually fine. All minor crops good.—*J. B. Marbury.*

Hawaii.—Entire month showery and cool. Young cane made only fair progress, its growth being checked somewhat by cool weather. Harvesting and milling of mature cane proceeded rapidly, quality of juice indicating a larger yield of sugar than originally estimated. Plowing and planting for 1907 cane crop continued. Rice heading and ripening in Oahu; a good crop expected. Fruit for summer crop of pineapples developed very satisfactorily. Exceptionally fine coffee blossom during month. Pastures much improved.—*Alex. McC. Ashley.*

Idaho.—The rainfall was very unevenly distributed over the State, but was generally sufficient for crop growth. Farm work made good progress and vegetation at the close of the month was in advance of the season. Range grass was exceptionally good and stock made satisfactory gains. Frost caused some damage to early fruits, and in some instances to apples, but there remained a prospect for a fair to good crop.—*Edward L. Wells.*

Illinois.—Frost forming temperatures pervaded the State on the 16-17th, extending to the furthermost southern limits. Fruits and tender vegetation were only slightly damaged. The month ended favorably for germination and plant growth. The sowing of oats, begun early in the month, was practically completed at the end of the second decade, and at the end of the month the crop was showing a good stand. Plowing for corn was well advanced the latter part of the month, and some planting had been done. Wheat, rye, and grasses had made good growth and were very promising.—*Wm. G. Burns.*

Indiana.—Sowing oats began during the first week, but, owing to interruptions by snow and rain and delay on account of wet ground, was unfinished at the close. Wheat, rye, and hay crops were in prime condition. Seedling peaches and other fruit promised fair crops. Early potatoes were planted. A little corn was planted, but, owing to wet ground, plowing progressed slowly. An increased acreage of corn was planted.—*W. T. Blythe.*

Iowa.—The mean temperature for the State was slightly below normal and the daily weather was unusually variable. Conditions were favorable for farm operations, except in portions of the southern section, where there was an excess of moisture. Seeding of wheat, oats, barley and flax was begun early and mostly completed before the 15th. Germination was retarded by brief cold periods, but a fair stand was secured. But little damage to fruit or cereals resulted from frequent frosts.—*John R. Sage.*

Kansas.—Wheat improved, beginning to head in extreme south. Oats

and barley all sown and up, showing good stands. Corn planting progressed well during the month; by the close of the month corn was up in southern and coming up in central counties. Potatoes planted; early planted up by the end of the month. Apples, apricots, cherries, pears, and plums bloomed well during the month. Grass improved slowly; alfalfa grew rapidly.—*T. B. Jennings.*

Kentucky.—Temperature near normal, with many warm days, yet several cold periods occurred. Month opened with farming operations and vegetation well advanced for the season. Wheat made excellent progress. Gardens, meadows, and pastures in excellent condition; oats and rye did well; tobacco plants promising. Good progress made in the preparation for and in the planting of corn, though hindered the latter part of the month by wet weather. Fruit trees blossomed with heavy bloom, though injured somewhat by freezing weather the 16–17th.—*F. J. Walz.*

Louisiana.—Frequent showers during the first and second decades kept the ground too wet for cultivation, and, as a result, farming operations were materially retarded. Cotton planting was not half completed in many sections at the close of the month. Corn planting progressed slowly. Sugar cane grew slowly, but looked well. Continued wet weather interfered with rice seeding. Crops were generally two to four weeks late. Truck gardens did well.—*I. M. Cline.*

Maryland and Delaware.—Temperature and precipitation averaged nearly normal. Warm, rainy weather prevailed first half, unfavorable, cloudy, and windy weather, with much low temperature, latter half of the month. Freezing temperature in every county on the 19th. At the close of the month wheat and rye were promising, grass very backward, oats coming up, and much corn ground prepared. Frost damaged cherry, plum, and peach prospects in northern and western Maryland and some southern localities, and killed early strawberry blooms in eastern counties. Apple trees developed heavy bloom by the 30th. Tobacco plants were plentiful.—*E. D. Emigh.*

Michigan.—Vegetation and germination made slow progress during the first two decades on account of cool, moderately dry weather. Warmer temperatures and moderately well-distributed showers during last decade started winter wheat and rye, meadows, and pastures nicely and forwarded germination. Field work made good progress throughout the month. Oat, barley, and pea seeding was well advanced, and early potato planting general, in the lower peninsula at the close of the month. Fruit buds were very promising.—*C. F. Schneider.*

Minnesota.—Most of the precipitation was before the 5th, and from the 26th to the 28th, with scattered snows in northern portions on 13th and 28th. Frozen soil delayed soil work almost every morning. At the end of the month spring wheat and oat seeding was practically finished, and the early seeded was coming up, with barley and flax seeding progressing well, and potato planting, gardening, and preparing for corn planting going on. All grasses growing slowly.—*T. S. Outram.*

Mississippi.—Farming operations were much hindered by excessive rains, which kept lowlands too wet to be plowed. Frost on the 17th damaged tender vegetation north. Considerable planting was done on uplands, where corn came up to good stands and by the close of the month was needing work. But little more than half of the cotton crop was planted. Oats made a thrifty growth. Strawberries yielded well. Minor crops and pastures did well. The outlook for fruits, except peaches, was favorable.—*W. S. Belden.*

Missouri.—In all sections of the State the month was favorable for farming operations. Killing frosts of the 15–17th resulted in more or less injury to fruits and early gardens. Corn planting was well under way in the southern sections during the first and second decades, and the wheat crop made excellent progress during the entire month. Cotton planting made fair progress, and oat sowing was completed about the 12th. Potato planting was completed during the earlier part of the month.—*George Reeder.*

Montana.—The month was mild, excepting a few cold days in the second decade. Very dry in eastern portion, frequent light showers in west, but not sufficient for vegetation owing to dry condition of soil from previous deficiency. Wheat seeding completed by 15th, much oats sown the latter part. Winter wheat, meadows, and alfalfa made fair progress. Cattle and sheep in good condition and turned on summer ranges in some sections. Planting of potatoes and garden truck begun.—*R. F. Young.*

Nebraska.—The first ten days of April were warm and farm work progressed rapidly under favorable conditions. Spring wheat and oats were mostly sown before the 15th The remainder of the month was cold, with several severe frosts, that damaged early fruit somewhat. The low temperature was unfavorable for the growth of oats and retarded corn planting. Only a very few fields of corn were planted in April. Winter wheat continued in fine condition.—*G. A. Loveland.*

Nevada.—The temperature and precipitation were both slightly below normal. The weather was generally favorable for farming operations the greater part of the month. Vegetation was about two weeks in advance of the average season at the beginning of the month. The soil conditions were fine for plowing and seeding. A severe frost on the 20th caused some damage to fruit blossoms in some of the western and southern districts.—*J. H. Smith.*

New England.—April was a very pleasant month, with more than the average number of fair and sunny days. While the temperature did not depart greatly from the seasonal average, the nights were considered unusually cool. The weather was very favorable to farm operations and to outdoor work generally. Much preparatory farm work was done and in southern sections considerable seeding and planting followed, but, owing to the cool, dry weather, germination and growth were slow—*J. W. Smith.*

New Jersey.—Temperature nearly normal; precipitation unevenly distributed and slightly below average. Month favorable for farming operations; plowing, planting, and seeding well advanced, especially in the southern section. Frequent killing frosts did some injury to early blooming strawberries, peaches, and asparagus; late orchard fruit trees uninjured—*Edward W. McGann.*

New Mexico.—A cool, wet month, with sharp frosts; some damage to early fruits, vegetables, alfalfa, and tender plants. Wheat, oat, and barley seeding and field pea, bean, corn, and potato planting continued throughout the month; early seeding came up well. Alfalfa and range grasses made rapid growth; alfalfa blooming in the southern valley at the close of the month. Stock improved rapidly generally, but severe losses occurred in northeastern counties. Lambing began in the second decade under very favorable grass and water conditions, and a large increase expected.—*Charles E. Linney.*

New York.—The weather during the month was generally favorable for farm work, but was too cool for the germination and growth of vegetation, which, as a result, was rather backward at the end of the month. The maple sugar season closed early and the yield was small. Winter grains and grass advanced fairly well, and the prospects were good for all kinds of fruit. Considerable oat sowing was done and a few potatoes were planted.—*H. B. Hersey.*

North Carolina.—Farming operations made fairly good progress during April, and the preparation of the soil for planting was advanced during every favorable opportunity. Much corn and cotton were planted. Tobacco plants in beds made slow growth. Wheat and oats improved materially. Killing frosts occurred on several dates, especially on the 17th, with much injury to fruit, tender truck crops, and young cotton. Shipments of early truck and strawberries began toward the close of the month.—*C. F. von Hermann.*

North Dakota.—The month was slightly colder than usual, while the precipitation was the least ever recorded in April since the establishment of the service. Farm work was delayed considerably by the ground freezing at nights so that it could be worked only in the afternoon, but in spite of that seeding of wheat was quite well advanced at the close of the month.—*B. H. Bronson.*

Ohio.—The weather during greater portion of month unfavorable to farm work and best growth of plant life. During the last week of the month it was favorable, and at the close wheat was reported in fine condition. Pastures and meadows making good growth. Clover promising. Oat seeding well commenced, some early sown up and appearing in good condition. Corn planting well begun over southern portion. Planting of potatoes well under way. Tobacco plants backward. Fruit prospects generally fair.—*J. Warren Smith.*

Oklahoma and Indian Territories.—Temperature below, precipitation decidedly above average. Farm work and crop growth retarded. Wheat stooled, jointed, and headed out in good condition, with some rust reported; a fair to good prospect. Oats, barley, rye, and spelt in good condition. Corn planting retarded, early up to poor to good stand, but yellow, some cultivated. Cotton about one-third planted and coming up to poor stand, a decreased acreage. Alfalfa, potatoes, gardens, grass, stock, and fruit doing well.—*C. M. Strong.*

Oregon.—The month throughout was favorable for agriculture. Fall wheat making splendid advancement. Spring wheat, oats, barley, hops, forage plants, and pastures grew nicely. Summer fallowing and planting of potatoes, corn, sugar beets, and gardens were well advanced. Stock in fine condition. Increase of lambs above the average. Frosts during early part of the month considerably damaged peaches, prunes, and early cherries. Apple bloom lighter than usual.—*Edward A. Beals.*

Pennsylvania.—At the close of the month, plowing, oat seeding, and the planting of potatoes were well under way, and the soil was in good condition, except in the northern tier of counties; winter grain, meadows, and pastures were promising; garden truck was somewhat backward; corn planting had been started in some southern counties and fruit trees were blossoming satisfactorily. The damage from the frosts on the 19th was much less than anticipated.—*T. F. Townsend.*

Porto Rico.—Rain was urgently needed during the second and the third weeks for young vegetation. The showers of the latter part of the period put young canes in excellent condition, but hindered the reaping of the present crop in the northern sections. Grinding continued throughout the month; the grade of juice was slightly less than normal. Coffee blossoms were hindered by heavy showers, but the outlook for a good crop appeared promising. Some tobacco was harvested; quality fair. Pineapples and minor fruits were maturing.—*M. A. Robinson.*

South Carolina.—The month was characterized by periods of unusually low temperature and the latest killing frost on record, and by the general variableness of its weather. The precipitation was ample. Farm work suffered many interruptions, but planting operations were about as far advanced as usual, and good stands were generally secured, except of cotton, which was largely killed on the 17th by frost, which also dam-

SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS, APRIL, 1905.

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.					Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest. Date.			Station.	Amount.	Station.	Amount.
Alabama	63.6	+ 1.0	Flomaton	92	27	Valley Head	25 17	3.69	−0.48	Notasulga	6.72	Burkville	1.05
			Lucy	92	29								
Arizona	58.0	− 3.2	Maricopa	98	30	Fort Defiance	12 3	2.46	+1.90	Showlow	6.26	Aztec	T.
			Parker	98	6								
Arkansas	61.1	− 0.7	Howe	96	9	Pond	26 6	6.29	+2.13	Pine Bluff	12.53	Dodd City	2.10
California	57.2	+ 0.4	Bakersfield	99	6	Bodie	6 2	1.18	−0.67	Delta	7.53	7 stations	0.00
			Volcano Springs	99	7								
Colorado	42.2	− 2.2	Las Animas	88	30	Whitepine	− 6 4	3.84	+2.56	Lake Moraine	8.70	Saguache	0.40
Florida	70.1	+ 1.0	Stephensville	98	19	Middleburg	32 18	2.52	+0.01	Marco	9.86	Monticello	0.90
Georgia	64.0	+ 0.9	Fleming	94	29	Clayton	26 18	3.33	−0.33	Dawson	6.31	Thomasville	0.82
Hawaii	†70.4	.....	Waialua Mill, Oahu	91	20	Wahiawa, Oahu	50 12	‡5.96	.....	Honomanu Valley, Maui	29.02	Waiawa, Kauai	0.01
Idaho	46.8	.....	Garnet, Lewiston	83	24	Lost River	8 1	1.29	.....	Grangeville	4.53	Ketchum	0.15
			Lovell			Roosevelt	8 3						
Illinois	52.1	− 0.1	Chester	92	9	Knoxville	20 5, 16	3.69	+0.60	Mascoutah	5.69	Benton	1.65
Indiana	51.7	− 0.5	Marengo	87	28	Auburn	20 8	3.75	+0.60	Anderson	5.22	Madison	2.21
			Mount Vernon	87	3	Hector	20 16						
Iowa	47.5	− 1.8	Clarinda	90	9	Tuwood, Sibley	10 14	3.03	+0.14	Leon	5.49	Sibley	0.63
Kansas	53.2	− 1.5	Toronto	97	28	Colby	12 15	2.51	−0.33	Ulysses	6.10	Valley Falls	0.82
Kentucky	56.7	+ 0.4	Shelbyville	91	10	Farmers	23 8	3.00	−0.74	Mount Sterling	4.57	Hopkinsville	1.87
Louisiana	67.7	+ 0.7	Alexandria	93	26	Ruston	35 17	8.95	+4.78	Melville	18.90	Port Eads	2.68
			Oxford	93	27								
Maryland and Delaware	52.8	+ 1.2	Boettcherville, Md	88	10	Deer Park, Oakland, Md	8 19	2.81	−0.45	McDonogh, Md	5.60	Boettcherville, Md	1.07
Michigan	41.9	− 1.3	Gladwin	85	28	Humboldt	7 6	1.99	−0.04	Hillsdale	3.63	Petoskey	0.45
Minnesota	42.0	− 1.7	Hallock	79	26	Pokegama Falls	7 16	1.46	−0.93	Mount Iron	3.97	RedwingNo.2(Cline)	0.23
Mississippi	64.2	− 0.2	Woodville	92	26	Ripley	25 17	7.38	+3.21	Magnolia	14.59	Booneville	3.60
Missouri	54.9	− 0.1	Versailles	92	9	Goodland	20 17	3.19	−0.58	Sublett	7.79	Bagnall	0.79
			Warrensburg										
Montana	43.2	+ 0.2	Ridgelawn	88	26	Grayling	− 1 2	0.90	−0.38	Nye	3.27	2 stations	0.00
Nebraska	46.5	− 2.9	Bartley	92	30	Agate	1 11	3.70	+0.93	Ansley	8.41	Nemaha	0.97
Nevada	47.0	− 1.5	Wabuska	85	22	Toano	10 1	0.84	−0.03	Lewer's Ranch	2.40	2 stations	0.00
						Eureka	10 10						
New England*	43.7	− 0.7	4 stations	79	3 dates	Oquossoc, Me	12 2	2.26	−0.68	Colchester, Conn	3.89	Eastport, Me	0.83
New Jersey	49.9	− 0.5	Indian Mills	84	21	Layton	18 3, 19	2.88	−0.55	Sandy Hook	4.03	Layton	1.53
New Mexico	49.5	− 2.8	Carlsbad	89	8	Elizabethtown	6 5	2.83	+2.04	Eagle Rock Ranch	5.90	Cambray	0.55
New York	43.6	− 0.1	Elmira	82	28	Faust	11 3	2.47	−0.17	Oxford	4.07	Ogdensburg	0.96
North Carolina	58.2	+ 0.8	Chalybeate Springs	92	29	Linville	20 19	4.07	+0.22	Edenton	8.20	Marion	1.95
North Dakota	40.2	− 1.0	Dickinson, Medora	83	26	Dickinson, Williston	3 16	0.63	−1.39	Forman	1.97	Willow City	T.
Ohio	48.5	− 1.4	Thurman	89	9	Cardington	12 8	3.10	+0.35	North Lewisburg	4.75	Rittman	1.68
Oklahoma and Indian Territories.	58.7	− 2.2	Chickasha, Ind. T	98	24	Kenton, Okla	27 24	4.35	+1.58	Goodwater, Ind. T.	8.97	Jenkins, Okla	1.12
Oregon	51.0	+ 2.9	Umatilla	90	24	Bend	16 11	1.12	−1.93	Bull Run	3.19	Grass Valley	0.03
						Riverside	16 10						
Pennsylvania	48.4	+ 0.3	Aleppo	84	1	Lawrenceville	16 15	2.84	−0.40	Indiana	4.74	Harrisburg	1.39
Porto Rico	76.5	.....	Mayaguez	98	19	Cidra	50 29	4.68	.....	Lares	12.15	Cidra	1.12
						Corozal	50 24						
South Carolina	62.8	+ 0.7	Walterboro	92	28, 29	Greenville	25 17	3.83	+0.22	Columbia	7.51	Barksdale	2.00
South Dakota	44.7	− 1.7	Kimball	87	7	Canton	8 14	1.23	−1.33	Elk Point	2.34	Fort Meade	0.49
Tennessee	58.7	+ 0.1	Johnsonville	91	28	Erasmus, Hohenwald	18 17	3.47	−0.89	Memphis	5.83	Nashville	1.50
Texas	64.5	− 2.0	Fort Ringgold	100	11	Clarendon	22 5	6.32	+3.44	Waco	13.01	Fort Ringgold	0.11
Utah	48.7	+ 1.0	Grayson	88	19	Government Creek	9 1	1.47	−0.31	Alpine	3.98	Trout Creek	0.25
Virginia	55.2	+ 1.3	Staunton	89	11	Burkes Garden	19 19	2.75	−0.56	Hampton	5.76	Greenwich	1.19
Washington	50.7	+ 2.1	Hatton	99	24	Northport	18 10	0.96	−1.70	Clearwater	3.05	Sunnyside	0.00
West Virginia	52.2	+ 0.6	Logan, Sutton	89	10	Bayard	14 19	2.78	−0.30	Pickens	5.57	Moorefield	1.10
			Williamson										
Wisconsin	43.5	− 1.8	Prentice	80	26	Amherst	10 7	1.36	−1.11	Racine	4.05	Downing	T.
						Koepenick	10 6						
Wyoming	39.4	− 1.0	Torrington	84	30	Lake Yellowstone, Y. N. Park	−10 11	2.41	+0.74	Pine Bluff	6.71	Embar	0.40

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † 47 stations, with an average elevation of 497 feet. ‡ 128 stations.

aged fruit in the western counties. Wheat and oats became promising. Most of the tobacco crop was transplanted.—*J. W. Bauer.*

South Dakota.—Though seeding operations were interrupted by unfavorable conditions, the month closed with spring wheat seeding finished and the sowing of oats, barley, and spelt fast nearing completion. Cool weather, and the latter part of the month dry surface soil, retarded growth of all vegetation. Early spring wheat, oats, barley, and spelt were in good condition, but insufficient moisture prevented prompt and even germination and growth of the later sown. Grass was backward and pasturage short, but live stock looked well. Plowing progressed satisfactorily. Potato planting was well advanced.—*S. W. Glenn.*

Tennessee.—Killing frosts about the 6th and 17th were very injurious to tender vegetation. Conditions were much more favorable during the last decade, and at the close of the month reports of crop conditions were very encouraging. Planting of corn and cotton was in full progress and some early plantings were up, with good stands. Strawberry shipments had begun. Wheat, oats, and clover were in fine condition of growth. Tobacco plants were growing rapidly. Truck crops were recovering from frost damage. There were some apples and peaches in highland sections.—*H. C. Bate.*

Texas.—Weather early in the month was fairly good for farm work, but showery weather later interrupted work. Cool early in the month, with frosts in northern and central counties, followed by warmer late in the month. Damage by frost slight, and crops largely recovered during the warmer weather. Cotton planting delayed by showers, and much replanting became necessary; crop fair to good in southern counties, but less favorable in northern and central counties. Other crops did fairly well, but corn was foul and rust appeared in wheat and oats. Grass did very well and stock improved greatly.—*M. E. Blystone.*

Utah.—Cloudy and changeable weather prevailed during the month, with frequent storms that thoroughly soaked the ground and retarded all farm work. Nevertheless, crops were in fine condition and making rapid growth. Seeding was still in progress, though nearing completion. Fall and early sown spring wheat were coming up well. Fruit was backward, though generally looking well, excepting peaches and apricots, which suffered severe damage from the cold weather in February. Sheep

shearing was nearly completed, with the clip excellent. The range was fine and stock thriving.—*R. J. Hyatt.*

Virginia.—With the exception of a cold period from the 17th to 19th, when killing frosts and ice occurred, and a local droughty condition during the month in portions of the great valley division, the general weather prevailing through the month was favorable for crop progress. Winter wheat and oats advanced steadily, and field work incident to the season was vigorously carried on. Some corn was planted and tobacco plants were abundant and thrifty. Gardens, truck crops, and fruit were considerably injured by frost.—*Edward A. Evans.*

Washington.—The weather was too dry in most localities to favor the rapid growth of vegetation, and, although a warm April on the average, there were such cool and frosty nights as to retard the progress of crops considerably. Some of the frosts, notably those of the 9th and 10th, were killing to early vegetables and certain fruits, such as cherries and prunes. Winter and spring wheat, barley, and hops made satisfactory progress, while grass, oats, gardens, and field potatoes grew slowly.—*G. N. Salisbury.*

West Virginia.—Light snowfall and freezing temperatures were general over the State from the 16th to 19th, but at other times the weather was fine and pleasant. At the close of the month wheat, rye, and grass were in very fair condition, and plowing for corn had progressed rapidly. Oat sowing was about completed, and potatoes were coming up. Some cherries, plums, and pears were killed by the freeze, but the prospects for peaches and apples, especially the latter, were better than expected.—*E. C. Vose.*

Wisconsin.—The month was colder and drier than usual, with freezing temperature generally over the State on the 6th and 7th. No serious damage occurred, as vegetation was not sufficiently advanced to be liable to injury. Winter wheat, rye, and grasses made good progress. Seeding of oats, barley, spring wheat, and spring rye was generally completed by the middle of the month, except in extreme northern counties. Preparations for corn and potatoes were well advanced by the end of the month.—*W. M. Wilson.*

Wyoming.—Over most of the State the month was too cool for the growth of crops and ranges, and in some portions of the southern counties the soil was too wet to work, and seeding was delayed. The heavy rains and snows caused some loss of lambs, calves, and shorn sheep, but were of great benefit to meadows and ranges. By the close of the month early sown grain was up and looking green, while in some sections seeding had not been completed.—*W. S. Palmer.*

SPECIAL ARTICLES.

STUDIES ON THE DIURNAL PERIODS IN THE LOWER STRATA OF THE ATMOSPHERE.

III.—THE DIURNAL PERIODS OF THE VAPOR TENSION, THE ELECTRIC POTENTIAL, AND COEFFICIENT OF DISSIPATION.

By Prof. FRANK H. BIGELOW.

THE DIURNAL VARIATION OF THE VAPOR TENSION.

In the MONTHLY WEATHER REVIEW for December, 1902, I made some remarks upon the phenomena involved in the changes of the semidiurnal periods of the barometric pressure, the atmospheric electric potential-fall, and the vapor tension, as they occur at the surface of the earth, into the simple diurnal periods which are observed in the strata above the ground. The present series of papers properly supplements that paper, but in this connection attention is fixed upon the annual variations in these two related periodicities for the purpose of determining the exact physical processes operating to produce the transformations recorded in those periods. Especially it is proposed to lead up to an explanation of the diurnal periods in the earth's magnetic field, which seem to be simply a meteorological effect of the radiation of the sun in the lower strata of the atmosphere, through the intermediate development of currents of electric ions in connection with the prevailing distribution of the temperature.

The hourly values of the vapor tension at the surface were not available at the Blue Hill Valley Station, and I decided not to take Boston, preferring a more inland station which should be freer from seacoast influences. In consequence of the convenience of the published record at Parc St. Maur, Paris, the mean diurnal variations of vapor tension at that place for the five years, 1897–1901, were computed, the results being given in Table 3. These variations at each hour relative to the daily mean are transferred to the curves of figs. 38–49, being the lower curve of each month. In order to obtain the hourly values of the vapor tension in the free air for the levels 195, 450, and 1000 meters at Blue Hill, I proceeded as follows: The temperatures computed at these elevations in Fahrenheit degrees were read from figs. 14–25, and they may be recovered from Table 2, by reversing the sign of ΔT as there recorded. These temperatures were converted into degrees centigrade. With this as an argument the vapor tension E was taken from Table 43 in the Smithsonian Meteorological Tables, edition of 1896, for saturation. Then, with the observed relative humidity at these levels for each hour, the corresponding vapor tension, $e = E \times R.H.$, was computed, and the results are given in Tables 4, 5, and 6. These variations of the vapor tension above the surface are also transferred to figs. 38–49, the mean monthly values appearing on the zero line, and the ordinate divisions being 0.40 mm. The values of the relative humidity in the free air at Blue Hill were extracted from the same report, and for each month, at the levels 195, 400, 1000 meters, all the available data were collected. Certain interpolations were made from observations at other heights, when practicable, in order to obtain more material for the discussion. The means were taken at each hour, and plotted on diagrams, and average lines were drawn through the points, from which approximate values were found. Then these values of the relative humidity for the hours 12 a. m., 4 a. m., 8 a. m., 12 p. m., 4 p. m., 8 p. m., were placed on a second system of sheets with the months as one argument, and mean lines were drawn. From these curves, which smoothed out minor irregularities, the second approximate hourly values at six points were found, and transferred to the first system of curves, which were reconstructed by the aid of them. This method of double cross-plotting involving two approximations, as before stated, is capable of dealing successfully with very rough data. An examination of the set of curves in the figs. 38–49 "Diurnal variation of the vapor tension, de, in the four levels 50 meters, Parc St. Maur, Paris, 195 meters, Blue Hill summit, 400 and 1000 meters in the free air over Blue Hill," leads to the following remarks on the behaviour of this element in the lower atmosphere.

(1) The mean vapor tension for the day decreases from a maximum at all levels in July and August to a minimum in the same levels in February, and from a maximum at the surface in each month to a series of lower values with the increase in elevation. This course is parallel with the seasonal change in the temperature, as may be seen by comparing the series of curves in figs. 14–25. The vapor content of the atmosphere is strictly a function of the temperature and the sources of evaporation of aqueous vapor, but for any given locality it is a function of the temperature alone when general averages are considered.

(2) For the diurnal period at the surface the year divides into two portions: first, November to February, when the diurnal variation has a single maximum, about 3 p. m., and a single minimum, about 6 a. m.; second, March to October, when the semidiurnal period is developed with maxima about 8 a. m., 8 p. m., and minima at 4 a. m. and 3 p. m., approximately. In March the maxima are located more closely together, also in October, than in the other months, showing that there is in this connection a transition between the single diurnal and the semidiurnal periodic systems. By comparing these curves with the series of figs. 2–13, "Temperature-falls in the lower strata," it is seen that the fully developed maxima of the vapor tension occur exactly in the midst of the hours of the most rapid temperature changes, 8 a. m., 8 p. m. When the lower atmosphere is heating most rapidly from the surface upward, convection currents form, which rise in the forenoon, carrying the products of fresh evaporation with them as an increase in the vapor tension. The surfaces covered